Ch 9 Stoichiometry AF/H

Ⓛ

↳ mass relationships b/tween reactants + products in rxns

Greek Stoichea - element metron - measure

Can do many types of ~~Rxn~~ calculations

A ⟶ B in a rxn

mole - mole problems

molesA → molesB

mole - mass

molesA → molB → mass B

mass - mole

mass A → molA → molB

mass - mass

mass A → molA → molB → mass B

~~Add~~

HMWK Ch 9 pg 265, Q4; p 271, Q1, 3, 5 p 278 Q3, 4

AF pg 279 Q5, 8, pg 280 Q14, 18, 20
p281 App Prob 3, 8

H pg 280 11, 12, 13, 18
p 281 Q22

mol ratio

$$2Al_2O_{3(l)} \longrightarrow 4Al_{(s)} + 3O_{2(g)}$$

$$\frac{2\ mol\ Al_2O_3}{4\ mol\ Al} = \frac{1}{2}\Big\} \text{or reciprocal of each}$$

$$\frac{2\ mol\ Al_2O_3}{3\ mol\ O_2} \quad \frac{4Al}{3O_2}$$

Knowing this if I have 13.0 mol of Al_2O_3 how many of O_2?

$$13.0\ mol\ Al_2O_3 \times \frac{3\ mol\ O_2}{2\ mol\ Al_2O_3} = 19.5\ mol\ O_2$$

If you know the ratio, you can do anything

Stochiometric calculations

mole-mol

$$mol \longrightarrow mol\ B \longrightarrow mol\ A \times \frac{mol\ B}{mol\ A} = mol\ B$$

$$CO_2 + 2LiOH \longrightarrow Li_2CO_3 + H_2O$$

How many mol of LiOH react w/ 20 mol CO_2?

Next do mole – mass, mass – mol, mass – mass

all ex

9.3 Limiting Reactant

- reactant that controls amount of product formed in rxn

excess reactant → reactant that is not used completely in rxn

Use airplane analogy

400 people + 350 seats

In the rxn

$$\underset{5\,mol}{CH_4} + \underset{10\,mol}{O_2} \longrightarrow CO_2$$

1 : 1

5 mol excess of O_2

How to determine limiting reactants

Given amounts of 2 reactants A + B, which is limiting

1. Use A to find # of mol of A you have.
2. Find mol B that mol A needs to react w/.
3. Compare mol B needed w/ mol B you have.
4. If you have more B than needed A is limiting
   ~~more~~ less B " " B " "

Ex Rxn

$$3Fe + 4H_2O \longrightarrow Fe_3O_4 + 4H_2$$

167g 36.0g

a. what is the limiting reagent?

b how much excess is left?

c. how much Iron Oxide Produced?

a. $167\,g \times \frac{1\,mol}{55.8\,g} = 2.99\,mol\,Fe \times \frac{4\,mol\,H_2O}{3\,mol\,Fe} = 3.99\,mol\,H_2O \times \frac{18\,g}{mol} = 71.8\,g\,H_2O$

Have 2.99mol Fe, for this req 3.99mol H_2O (71.8g H_2O)

only have 36.0g H_2O therefore H_2O is limiting.

Fe is excess.

b to do this must calculate # mol of H_2O

$$36.0\,g \times \frac{1\,mol}{18\,g} = 2\,mol\,H_2O \times \frac{3\,Fe}{4\,H_2O} = 1.5\,mol\,Fe \times \frac{55.8\,g\,Fe}{mol} =$$

83.7g Fe needed.

$167\,g - 83.7\,g\,Fe = 83.3\,g$ left.

c $2\,mol\,H_2O \times \frac{1\,Fe_3O_4}{4\,mol\,H_2O} \times \frac{231.4\,g}{mol} = 116\,g\,Fe_3O_4$ made.

% Yield, Theoretical yield, Actual Yield

Theoretical yield → max amount of product ~~calculated~~ that can be ~~determined~~ obtained in a rxn (mathematically determined).

Actual yield → actual amount of product obtained in a rxn (experimentally observed)

Percent yield → $\frac{\text{actual}}{\text{theoretical}} \times 100\%$

Ex Rxn $C_6H_6 + Cl_2 \longrightarrow C_6H_5Cl + HCl$

36.8 g yields 38.8 g

Find % yield.

1st Theoretical $36.8\text{ g} \times \frac{1\text{ mol}}{78.1\text{ g}} \times \frac{1\text{ mol } C_6H_5Cl}{1\text{ mol } C_6H_6} \times \frac{113\text{ g } C_6H_5Cl}{\text{mol } C_6H_5Cl} = 53.2\text{ g } C_6H_5Cl$

$\% = \frac{38.8\text{ g}}{53.2\text{ g}} \times 100\% =$ ~~72.9%~~ 72.9 %